

Application Serial No. 10/649,577
Attorney Docket No.: 0140153

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REMARKS

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Claims 1-8, 16, 17, and 20-28 are pending in the present application.

Reconsideration and allowance of pending claims 1-8, 16, 17, and 20-28 in view of the following remarks are requested.

A. Rejection of Claims 1-6, 16, 20-26, and 27 under 35 USC §102(e)

The Examiner has rejected claims 1-6, 16, 20-26, and 27 under 35 USC §102(e) as being anticipated by U.S. patent number 6,001,671 to Joseph Fjelstad (hereinafter "Fjelstad"). For the reasons discussed below, Applicants respectfully submit that independent claim 1 is patentably distinguishable over Fjelstad.

Independent claim 1 recites, among other things, attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive, and removing the removable material from conductive features formed within the conductive material and from an encapsulant. As disclosed in the present application, in one embodiment removable tape 310 is attached to metal frame 300 to prevent the adhesion of encapsulant to bottom surface 320 of frame 300. As further disclosed in the present application, tape 300 can comprise, for example, a polyimide material and a water soluble adhesive.

As stated in the present application, after the structure including connector 120, base 130, wire 140, and device 150 has been formed and encapsulated with molding

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compound, tape 310, which comprises a soluble adhesive, can be removed by immersing it (i.e. tape 310) in hot water. Any residual adhesive may be removed by using a solvent such as deionized water, for example. Thus, by using an adhesive material that is water soluble, an embodiment of the invention provides a removable material for protecting a bottom surface of a frame from encapsulating material, where the removable material can be inexpensively and easily removed.

In contrast to amended independent claim 1, Fjelstad does not teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive, and removing the removable material from conductive features formed within the conductive material and from an encapsulant. Fjelstad specifically discloses patterning conductive pads 110' and conductive region 115' in conductive layer 101' on dielectric polymer sheet 100', bonding semiconductor chip 120' to conductive region 115', electrically connecting semiconductor chip 120' to conductive pads 110' by wirebonding wires 130', and encapsulating conductive pads 110', conductive region 115', semiconductor chip 120', and wirebonding wires 130'.

See, e.g., column 5, lines 27-46 and Figures 2A-2D of Fjelstad.

In Fjelstad, portions of dielectric polymer sheet 100' are then removed by chemical etching or laser ablation operations so as to expose pads 110' and conductive region 115'. *See, e.g., Fjelstad, column 5, lines 46-49.* In Fjelstad, if a wiring layer is not needed, the entire dielectric polymer sheet 100' may be removed by chemically dissolving the sheet,

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thereby leaving the pads and the central conductive region exposed. *See, e.g.,* Fjelstad, column 5, lines 60-65. Thus, Fjelstad discloses a dielectric polymer sheet, e.g., dielectric polymer sheet 100' that may be partially removed by chemical etching or laser ablation or entirely removed by chemical dissolution. In contrast, independent claim 1 specifies a removable material comprising a soluble adhesive, where the removable material is removed from conductive features. Applicants submit that the dielectric polymer sheet disclosed in Fjelstad is not a removable material comprising a soluble adhesive, as specified in independent claim 1. In fact, Fjelstad does not even mention a soluble adhesive.

On page 5 of the Final Office Action dated January 11, 2007, the Examiner states that "the polymer sheet can be dissolved and soluble in a specific chemical etching solution, inherently." Assuming, arguendo, that the polymer sheet can be said to be soluble in a specific chemical etching solution, the polymer sheet does not comprise a soluble adhesive, as specified in independent claim 1. Also, Fjelstad discloses that the sacrificial layer is comprised of dielectric polymer sheet 100' having conductive layer 101' on one surface of the sacrificial layer 100'. *See, e.g.,* column 5, lines 28-31 and Figure 2A of Fjelstad. However, Fjelstad does not teach, disclose, or suggest a step of attaching a removable material to a surface of a conductive material, as specified in independent claim 1.

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For the foregoing reasons, Applicants respectfully submit that independent claim 1 is not suggested, disclosed, or taught by Fjelstad. As such, independent claim 1 is patentably distinguishable over Fjelstad. Thus, claims 2-6, 16, and 20-27 depending from independent claim 1 are also patentably distinguishable over Fjelstad for at least the reasons presented above and also for additional limitations contained in each dependent claim.

B. Rejection of Claims 7-8 and 17 under 35 USC §103(a)

The Examiner has rejected claims 7-8 and 17 under 35 USC §103(a) as being unpatentable over Fjelstad, as applied to claims 1-6, 16, 20-27, taken with U.S. patent number 6,111,199 to Wyland et al. (hereinafter "Wyland") and Weng et al. (hereinafter "Weng"). For the reasons discussed below, Applicants respectfully submit that claims 7-8 and 17 are patentably distinguishable over Fjelstad, Wyland, and Weng, either singly or in any combination thereof.

Claim 7 includes, in addition to the limitations of base claim 1 discussed above, the limitation "wherein the removable material is water soluble adhesive." As discussed above, Fjelstad fails to teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive.

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Wyland specifically discloses package 320 including ring 322, which is mounted on substrate 324 underneath leads 321I and 321J to support each lead during wire bonding so as to prevent the leads from deforming due to pressure applied by the wire bonding machine. *See, e.g.*, column 7, lines 33-36 and Figure 3B of Wyland. In Wyland, ring 322 is not attached, either permanently or temporarily to the leads, but merely keeps the leads from collapsing during wire bonding. *See, e.g.*, column 7, lines 44-48 and Figure 3B of Wyland. In Wyland, ring 322, which can include an adhesive that can be, for example, a water-soluble resin composition, can be dissolved in a solvent after wire bonding. *See, e.g.*, Wyland, column 7, lines 48-67 and column 8, lines 1-3.

However, Applicants submit that the structure and use of ring 322 is significantly different than sacrificial layer in Fjelstad. In particular, the sacrificial layer in Fjelstad is utilized to protect bottom surfaces of conductive pads and a conductive region from encapsulant and is partially removed to expose the bottom surfaces of the conductive pads and conductive region after the encapsulant has been applied. In contrast, ring 322 is mounted on a substrate under leads to prevent the leads from deforming due to pressure applied to the leads by a wire bonding machine. Also, the sacrificial layer comprises a dielectric polymer sheet (e.g. dielectric polymer sheet 100') having a conductive layer (e.g. conductive layer 101') on one surface, while ring 322 in Wyland can comprise, for example, filler particles (such as sand particles) dispersed in an adhesive. As such,

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Applicants respectfully submit that there is no motivation to combine Fjelstad and Wyland as suggested by the Examiner.

Weng is directed to splatter-free and debris-free wafer marking process in which a marked polymeric tape is first mounted onto a wafer surface which is then etched by either a dry etchant or a wet etchant to reproduce the mark in the wafer surface. Weng specifically discloses process 10 including step 60, in which a polymeric based tape is removed from the surface of the wafer (or the electronic substrate) to produce a wafer marked with the desirable identification mark. *See, e.g.,* column 5, lines 27-30 and Figure 1 of Weng. In Weng, a completed, marked wafer without the polymeric tape can then be cleaned with deionized water to remove any residue of the adhesive. *See, e.g.,* Weng, column 5, lines 34-37. However, the debris-free wafer marking method disclosed in Weng is completely unrelated to the method of manufacturing a semiconductor chip package disclosed in Fjelstad and also completely unrelated to an integrated circuit package using a gas to insulate electrical conductors disclosed in Wyland.

As such, Applicants respectfully submit there is a lack of sufficient motivation to combine Fjelstad, Wyland, and Weng as suggested by the Examiner. Thus, Applicants respectfully submit that the purported teachings suggested by the Examiner (i.e. the combination of Fjelstad, Wyland, and Weng) are based on hindsight reconstruction given the benefit of Applicants' disclosure, which is impermissible. Thus, for the foregoing reasons, Applicants respectfully submit that claim 7, which depends from independent

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claim 1, and claim 8, which depends from claim 7, are patentably distinguishable over Fjelstad, Wyland, and Weng, either singly or in any combination thereof.

Also, claim 17, which depends from independent claim 1, includes the limitation "wherein the removable material comprises a polyimide material and a water soluble adhesive." For similar reasons as discussed above, Applicants respectfully submit that a removable material as specified in independent claim 1, where the removable material comprises a polyimide material and a water soluble as specified in dependent claim 17, is not taught, disclosed, or suggest by Fjelstad, Wyland, and Weng, considered either singly or in any combination thereof. Thus, Applicants respectfully submit that claim 17, which depends from independent claim 1, is also patentably distinguishable over Fjelstad, Wyland, and Weng.

C. Rejection of Claim 28 under 35 USC §103(a)

The Examiner has rejected claim 28 under 35 USC §103(a) as being unpatentable over Fjelstad taken with U.S. patent number 4,530,152 to Roche et al. (hereinafter "Roche"). For the reasons discussed below, Applicants respectfully submit that independent claim 28 is patentably distinguishable over Fjelstad and Roche, either singly or in combination thereof.

Independent claim 28 includes similar limitations as independent claim 1. Thus, for similar reasons as discussed above, independent claim 28 is also patentably

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distinguishable over Fjelstad. In addition to the limitations in independent claim 1, independent claim 28 also includes the limitation of removing the removable material from conductive features and encapsulant after the singulation process is performed to separate the package. In contrast, Fjelstad discloses dicing the packages into either individual packages or multichip packages after portions of polymer sheet 100' are removed to expose pads 110' and central conductive region 115'. *See, e.g., Fjelstad, column 5, lines 46-51.*

In contrast, Roche does not teach, disclose, or suggest does not teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive, and removing the removable material from conductive features formed within the conductive material and from an encapsulant, where the removable material is removed from the conductive features and the encapsulant after a singulation process is performed to separate the package. Roche specifically discloses depositing thin conductive layer 6 of low melting point alloy on metal substrate 7, forming metal connection areas 3 and 4 on alloy layer 6, positioning chip 1 on connection area 4, connecting chip 1 to connection areas 4 by wires 2, and encapsulating chip 1, wires 2, and connection areas 3 and 4 with hardenable resin 5. *See, e.g., column 2, lines 60-68, column 3, lines 1-61 and Figures 1, 2, and 3 of Roche.*

In Roche, alloy layer 6 is melted by heating it to a relatively low temperature in order to remove temporary metal substrate 7. *See, e.g., Roche, column 3, lines 62-64.*

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However, Roche fails to teach, disclose, or suggest attaching a removable material comprising a soluble adhesive to a surface of a conductive material, as specified in independent claim 28. Additionally, Roche states that melting of the alloy layer also leaves a film of tin-lead alloy on the exposed surfaces of the connection areas, so that the tinning operation normally required prior to soldering on the external connections is not required in this instance. *See, e.g.*, Roche, column 4, lines 9-13. Thus, Roche teaches away from attaching a removable material comprising a soluble adhesive to a conductive material, since a soluble adhesive does not provide the advantage of eliminating a tinning operation that is achieved in Roche by melting a tin-lead alloy film.

In Roche, each component is separated from the others after encapsulation with and hardening of the resin, by sawing or other cutting technique, and either before or after removal of the temporary substrate. *See, e.g.*, Roche, column 4, lines 20-24. On page 5 of the Final Office Action dated January 11, 2007, the Examiner states that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the removable material of Fjelstad either after a singulation process to separate the package or prior to a singulation process as alternatively taught by Roche." However, as discussed above, Fjelstad discloses removing portions of dielectric polymer sheet 100' by chemical etching or laser ablation operations so as to expose pads 110' and conductive region 115', and then dicing the packages into either individual packages or multichip packages.

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As is known by one of ordinary skill in the art, a masking step is required to expose the portions of dielectric polymer sheet 100' that are to be removed by chemical etching or laser ablation operations and to protect the portion of dielectric polymer sheet 100' that is to remain on the package. Applicants respectfully submit that performing the masking step on the wafer is significantly easier and more cost effective than masking each individual package, which would be required if portions of dielectric polymer sheet 100' in Fjelstad are removed after the packages have been separated from the wafer. Also, Fjelstad fails to teach, disclose, or suggest any advantages to removing portions of the dielectric polymer sheet after dicing the wafer that offset the advantages realized by removing portions of the dielectric polymer sheet from the package before dicing the wafer, as discussed above. Accordingly, Applicants respectfully submit that there is insufficient motivation to combine Fjelstad and Roche as suggested by the Examiner.

For the foregoing reasons, Applicants respectfully submit that independent claim 28 is not suggested, disclosed, or taught by Fjelstad and Roche. As such, independent claim 28 is patentably distinguishable over Fjelstad and Roche.

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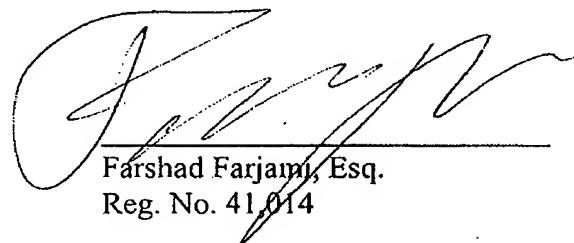
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D. Conclusion

Based on the foregoing reasons, independent claims 1 and 28, and claims depending therefrom, are patentably distinguishable over the art cited by the Examiner. For all the foregoing reasons, an early Notice of Allowance for pending claims 1-8, 16, 17, and 20-28 is respectfully requested.

Respectfully Submitted,
FARJAMI & FARJAMI LLP



Farshad Farjami, Esq.
Reg. No. 41,014

FARJAMI & FARJAMI LLP
26522 La Alameda Ave., Suite 360
Mission Viejo, California 92691
Telephone: (949) 282-1000
Facsimile: (949) 282-1002

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